(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 500 329 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **92301337.9**

(51) Int. Cl.^{5} : **B60G 21/055**

(22) Date of filing : **19.02.92**

(30) Priority : **22.02.91 US 660132**

(43) Date of publication of application :
26.08.92 Bulletin 92/35

(84) Designated Contracting States :
DE FR GB IT SE

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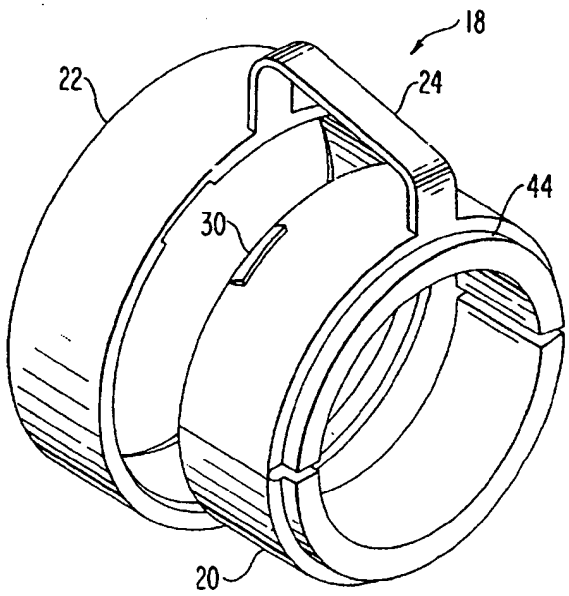
(54) Stabilizer bar/locking member combination.

(57) A locking member (18), preferably used for preventing axial displacement of a stabilizer bar (52) on an automobile, includes inner and outer elements (20, 22) interconnected by a strap (24). The inner element (20) includes two portions (26, 28) joined to each other by a living hinge (34). Contacting surfaces of the inner and outer elements (20, 22) are tapered to generate a clamping force when the outer (22) element is assembled over the inner element (20).

FIG. 1



EP 0 500 329 A2

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is directed to a two element locking member, particularly for use in maintaining a stabilizer bar of an automotive suspension system in a relatively stationary position. The invention is additionally directed to an automotive stabilizer bar having a two element locking member of this invention assembled on the stabilizer bar.

2. Description of Related Art

Stabilizer bars are torsion springs which conduct movement of an automotive suspension from one side of an automobile to the other, and they are commonly used to reduce the tendency of a chassis to roll during cornering. A stabilizer bar is usually mounted to the chassis of an automobile by means of resilient bushings. For proper operation, the stabilizer bar should be free to rotate in the bushings, yet restricted from movement through the bushings along the length of the stabilizer bar.

One common approach to controlling the movement of a stabilizer bar along its length includes forming an annular upset ridge on the stabilizer bar in a hot forming operation. This ridge is positioned to contact an edge of an adjacent bushing to hold the stabilizer bar in place. Because the annular ridge is formed by a hot pressing operation, a large capital expenditure is required for the necessary tooling, and the maximum size of the ridge is limited. In extreme cases, the ridge may actually move into the rubber bushing, holding the stabilizer bar out of the centered position.

Another approach involves placing a length of a rubber hose and a hose clamp on the stabilizer bar to form a stop which limits axial movement of the stabilizer bar.

It is an object of this invention to provide an improved means for maintaining a stabilizer bar in a selected position, which avoids the need to create an upset ridge on the stabilizer bar, and which can be quickly installed.

SUMMARY OF THE INVENTION

According to a first aspect of this invention, a two element locking member comprises an inner element, an outer element, and a strap interconnecting the inner and outer elements. The inner element comprises at least first and second portions which are joined to each other by at least one hinge at one end of the each of the two portions. Each of the portions comprises a first tapered surface, tapered along a longitudinal axis of the inner element, and the outer element comprises a second tapered surface, tapered along an axis of the outer element. The tapered surfaces are oriented to allow insertion of the inner element into the outer element, and they generate clamping forces tending to hold the locking member in place once the two elements are assembled.

According to a second aspect of this invention, a locking member comprises inner and outer elements as described above. At least one locking ridge is positioned on one of the inner and outer elements, and at least one ramp is formed on the other of the inner and outer elements to receive the locking ridge. The length of the ramp is less than the length of the first tapered surface along the first axis, and the first and second tapered surfaces are oriented to allow insertion of the inner element into the outer element.

The two element locking member is installed on a stabilizer bar by placing the first and second portions around the stabilizer bar and sliding the outer element over the inner element such that the tapered surfaces clamp the inner element in place on the bar. Once assembled, the locking member is substantially fixed in position on the bar and acts as a stop that cooperates with the bushing to hold the bar in a centered position.

This invention is also directed to an automotive stabilizer bar having a two element locking member applied thereto. This locking member comprises an inner element and an outer element, wherein the inner element comprises at least two portions. Each of the portions comprises an interior surface in contact with the stabilizer bar and an external surface, and one of the surfaces of each of the portions defines a first tapered surface which is tapered along an axis of the inner element. The outer element comprises an interior surface in contact with the inner element and an external surface, and the interior surface of the outer element defines a second tapered surface which is tapered along an axis of the outer element. The first and second tapered surfaces cooperate to generate an inwardly directed clamping force which clamps the inner element in position on the stabilizer bar.

The two element locking member of this invention has a number of advantages. It is relatively inexpensive to produce, and it eliminates the high tooling cost needed to form the upset ridge of the prior art. The strap and hinge cooperate to maintain the entire locking member as a unitary assembly prior to insertion of the inner element into the outer element, thereby simplifying assembly, inventorying and purchasing.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a preferred embodiment of the two element locking member of this invention.

Fig. 2 is a side view of the locking member of Fig. 1.

Fig. 3 is a top view of the locking member of Fig. 1.

Fig. 4 is a cross-sectional view taken along line 4-4 of Fig. 3.

Fig. 5 is a cross-sectional view taken along line 5-5 of Fig. 3.

Fig. 6 is an illustration of the locking member of Fig. 1 positioned on a stabilizer bar, prior to assembly.

Fig. 7 is an illustration of the stabilizer bar of Figure 7 with the locking member fully assembled.

Fig. 8 is a cross-section of the inner element of an alternative embodiment of the locking member of this invention.

Figs. 9A, 9B and 9C are illustrations of the assembly of the inner element of Fig. 8 with an outer element similar to that of Fig. 4.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Turning now to the drawings, Fig. 1 shows a two element locking member 18 comprising an inner element 20 and an outer element 22. The inner element 20 is attached to the outer element 22 by a flexible strap 24, and the elements 20, 22 and the strap 24 are preferably molded as an integral unit. The inner and outer elements 20, 22 are shown in detail in Figs. 3, 4, and 5.

As illustrated in Fig. 3, the inner element 20 includes first and second portions 26, 28 which are joined to each other at ends 33, 33' by a living hinge 34. Each of the two portions 26, 28 defines an interior surface 27, 29 and an external surface 25, 31. Each of the two portions 26, 28 also defines a locking ridge 30, 30' which locks the inner element 20 within the outer element 22 as described below. When the first portion is brought into contact with the second portion, the two portions 26, 28 define a substantially annular shape.

The opposed ends 35, 35' of each of the two portions are shaped in such a manner that a gap is formed therebetween when the inner element 20 is placed around a stabilizer bar as described below. This gap allows the inner element 20 to accommodate stabilizer bars having a range of diameters.

The interior surfaces 27, 29 are circularly cylindrical and the external surfaces 25, 31 define first tapered surfaces (Figs. 1, 2 and 5). The first tapered surfaces extend substantially along the entire width of the external surfaces 25, 31. In this preferred embodiment, each of the first tapered surfaces is a portion of a frusto-conical surface oriented at an angle of about 1° to 5° (preferably about 2°) with respect to the longitudinal axis A1.

Turning now to Fig. 4, the outer element 22 comprises a unitary ring having an external surface 45 and an interior surface 46. The interior surface 46 of the outer element 22 defines recessed ramps 23, 23' oriented to receive the ridges 30, 30', respectively (Fig. 3). The ramps 23, 23' are shaped to facilitate insertion of the ridges 30, 30' into the outer element 22. The interior surface 46 also defines a second tapered surface extending substantially along the entire width of the interior surface 46 along the longitudinal axis A2. In this preferred embodiment, the second tapered surface also is a frusto-conical surface which defines an angle of about 1° to 5° (preferably about 2°) with respect to the axis A2. The ramps 23, 23' are shorter than the second tapered surface along the axis A2 to maximize the area of the second tapered surface. The outer element 22 also defines a flange 50 (Fig. 4) for receiving the ridges 30, 30'.

Fig. 6 shows the locking member 18 placed about a stabilizer bar 52 which is supported by a frame 54. Both the stabilizer bar 52 and the frame 54 are conventional in the art. Fig. 6 shows the locking member 18 prior to assembly and Fig. 7 shows the stabilizer bar 52 with the locking member 18 fully assembled. The first and second tapered surfaces defined by the external surfaces 25, 31 and the interior surface 46 provide a clamping force that secures the inner element 20 on the stabilizer bar 52. The ridges 30, 30' lock the inner element 20 in the assembled position in the outer element 22, and the assembled locking member acts as a stop to locate the stabilizer bar 52.

The following details of construction are provided merely as an example, and are not to be construed as limiting. In this embodiment, the width of the ridges 30, 30' is preferably 9.5mm, the internal taper of the ramps 23, 23' is 20°, the depth of the ridge 50 is 2mm, the height H (Fig. 4) of the outer element 22 is 16mm and the height G (Fig. 5) of the inner element 20 is 18.2mm. The beveled surface of each locking ridge 30, 30' is preferably oriented at an angle of about 45° with respect to the axis A1. Both portions 26, 28, the strap 24 and the hinge 34 are preferably made of a thermoplastic material such as Nylon 6/6 and are preferably injection molded as a single unit. The outer element 22 is highly stressed, and for this reason it is preferred to inject the thermoplastic material that forms the outer element 22 radially outwardly via a gate that extends over 360°, and then to force the material axially through the mold. Additives such as rubber or glass fibers may be mixed with the thermoplastic material to obtain the desired structural properties.

Figs. 8 and 9 illustrate an alternative embodiment of the invention. In Figs. 8 and 9 parts of the alternative embodiment which correspond to numbered parts of the embodiment of Figs. 1 - 7 are numbered with a prefix of "200," followed by the numeral corresponding to the numeral used to identify the corresponding parts of the embodiment of Figs. 1 - 7. For example, the living hinge 34 of Fig. 3 corresponds to the living hinge 234 of Fig. 8.

The primary difference between the embodiment

of Figures 8 and 9 and the embodiment of Figures 1-7 is that the inner element 220 defines recesses 232, 232′ beneath and in alignment with the ridges 230, 230′. These recesses are positioned to provide a space into which the ridges can move when compressed by the outer element 222 during assembly.

As shown in Figs. 9A-9C, the inner element 220 is inserted into the outer element 222 in such a fashion that the ridges 230, 230′ are elastically deformed inwardly. This deformation is facilitated by the openings 232, 232′ which reduce stress on the ridges. Once the inner element 220 is fully inserted into the outer element 222 and the ridges protrude on the opposite side of the outer element, they are engaged by the outer element in the flange 250 (see Fig. 9C).

In another variation, the locking means for locking the inner element 20 within the outer element 22 may comprise a suitable adhesive between mating surfaces. A suitable adhesive is a micro-encapsulated epoxy such as that supplied by 3M Company. At the time of assembly, the capsules are broken, thereby activating the epoxy. Another approach to retaining the two elements together is to rely on the friction between the inner and the outer elements 20, 22. This friction may be increased by roughening the surfaces 25, 27, 29, 46 by sand-blasting the mold surfaces used to form these surfaces, as for example with an 60-1000 (preferably about 160) aluminum oxide grit. This enhances the frictional grip between the interior surface of the inner element and the stabilizer bar, as well as between the interior surface of the outer element and the external surface of the inner element.

The inner element can also be welded to the outer element for example by sonic welding to hold the assembled locking member together. The combination of any of these means can also be used. For example, the mechanical interlock illustrated in the embodiments of Figs. 1-9 can be combined with roughened mating surfaces.

The embodiments described above provide a number of significant advantages. The strap 24 automatically aligns the inner element 20 with the outer element 22 for assembly. This is particularly important if the locking ridges 30, 30′ are to cooperate with the ramps 23, 23′. The living hinge 34 also facilitates assembly of the locking member 18. In the event adhesive is used to secure the inner element 20 to the outer element 22, the strap 24 can be used to support the inner element as it is dipped in the adhesive, while the outer element 22 is held out of the adhesive.

The locking member functions reliably on bars that vary in diameter by ± .25 mm. The inner and outer elements 20, 22 are dimensioned to grip a bar at the smaller end of the anticipated range of bar diameters. When the inner element is applied to a larger diameter bar a gap is formed between adjacent ends of the first and second portions 26, 28, and the outer element 22 expands to accomodate the increased diameter of the inner element 20.

It is intended that the foregoing detailed description be regarded as illustrative rather than limiting, and that it be understood that it is the following claims, including all equivalents, which are intended to define the scope of this invention.

Claims

1. An automobile stabilizer bar (52) comprising a two element locking member (18) comprising an inner element (20) and an outer element (22), the inner element (20) comprising at least two portions (26, 28), each of said two portions (26, 28) comprising an interior surface (27, 29) in contact with the stabilizer bar and an external surface (25, 31), wherein one of said surfaces of each of said two portions (26, 28) defines a first tapered surface (25, 31) which is tapered along an axis (A1) of the inner element, the outer element (22) comprising an interior surface (46) in contact with the inner element (20) and an external surface (45), wherein the interior surface (46) of the outer element (22) defines a second tapered surface (46) which is tapered along an axis (42) of the outer element (22), said first and second tapered surfaces (25, 31, 46) cooperating to generate an inwardly directed clamping force which clamps the inner element (20) in position on the stabilizer bar (52).

2. The invention of claim 1 wherein said two portions (26, 28) are joined to each other by at least one hinge (34) at one end of each of said two portions (26, 28).

3. The invention of claim 2 wherein the hinge (34) is oriented parallel to the axis (A1) of the inner element (20).

4. The invention of claim 1 wherein the locking member (18) comprises at least one locking ridge (30, 30′) protruding from one of the inner and outer elements (20, 22) to lock the inner and outer elements (20, 22) together in an assembled relationship.

5. The invention of claim 1 wherein the inner element (20) comprises at least one locking ridge (30) protruding from the external surface (25) of the first portion (26) and at least one locking ridge (30′) protruding from the external surface (31) of the second portion (28), said locking ridges (30, 30′) shaped to lock the inner and outer elements (20, 22) together in an assembled relationship.

6. The invention of claim 2 wherein said two portions

comprise a first portion and a second portion (26, 28), wherein the ends of the first and second portions (26, 28) opposed to the hinge (34) are shaped to create a gap therebetween.

7. The invention of claim 1 wherein the outer element (22) defines a substantially circular shape, and wherein the first and second portions (26, 28) define a substantially circular shape when the inner element (20) is inserted within the outer element (22).

8. The invention of claim 1 wherein the locking member (18) further comprises a strap (24) interconnecting the inner element (20) and the outer element (22) such that the portions of the inner element (20) and the outer element (22) form a unitary construction.

9. A two element locking memeber (18) comprising an inner element (20), an outer element (22) and a strap (24) interconnecting the inner element (20) and the outer element (22), the inner element (20) comprising at least first and second portions (26,28) which are joined to each other by at least one hinge (34) at one end of each of the two portions (26,28), each of the said two portions (26,28) comprising a first tapered surface (25,31) which is tapered along a longitudinal axis (A1) of the inner element (20), the outer element (22) comprising a second tapered surface (46) which is tapered along an axis (42) of the outer element (22), said first and second tapered surfaces (25,31,46) being orientated to allow insertion of the inner element (20) into the outer element (22) and cooperating to generate a clamping force to hold the locking member (18) in place once the two elements (20,22) are assembled.

10. A two element locking member in accordance with claim 9, wherein at least one locking ridge (30,30') is provided on one of the inner and outer elements (20,22) and at least one ramp (23,23') is formed on the other of the inner and outer elements (20,22) to receive the said at least one locking ridge (30,30'), the length of the said at least one ramp (23,23') being less than the length of the first tapered surface (25,31) along the first axis (A1).

FIG. 1

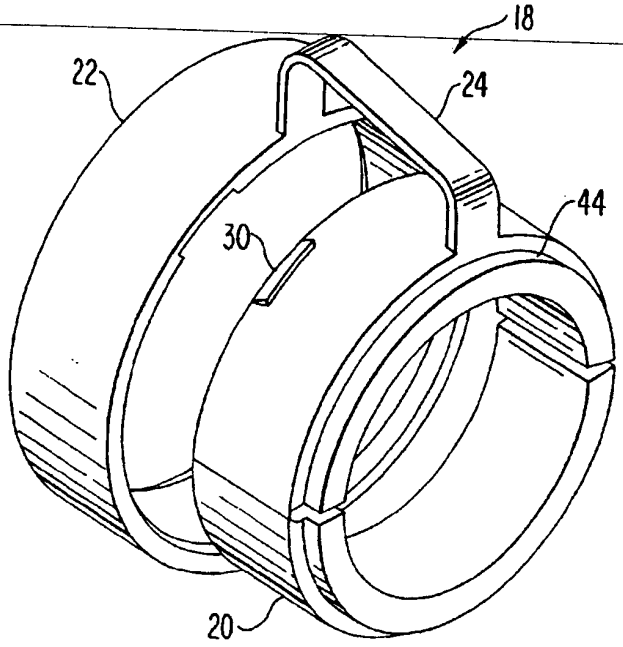


FIG. 2

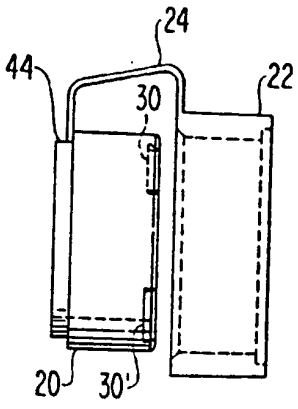
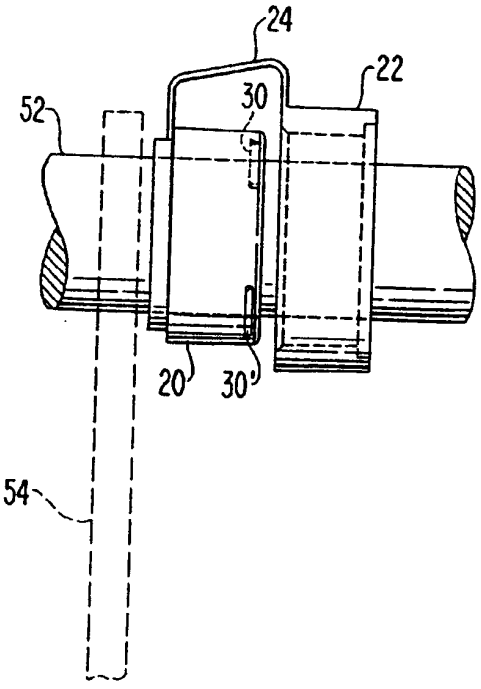


FIG. 6



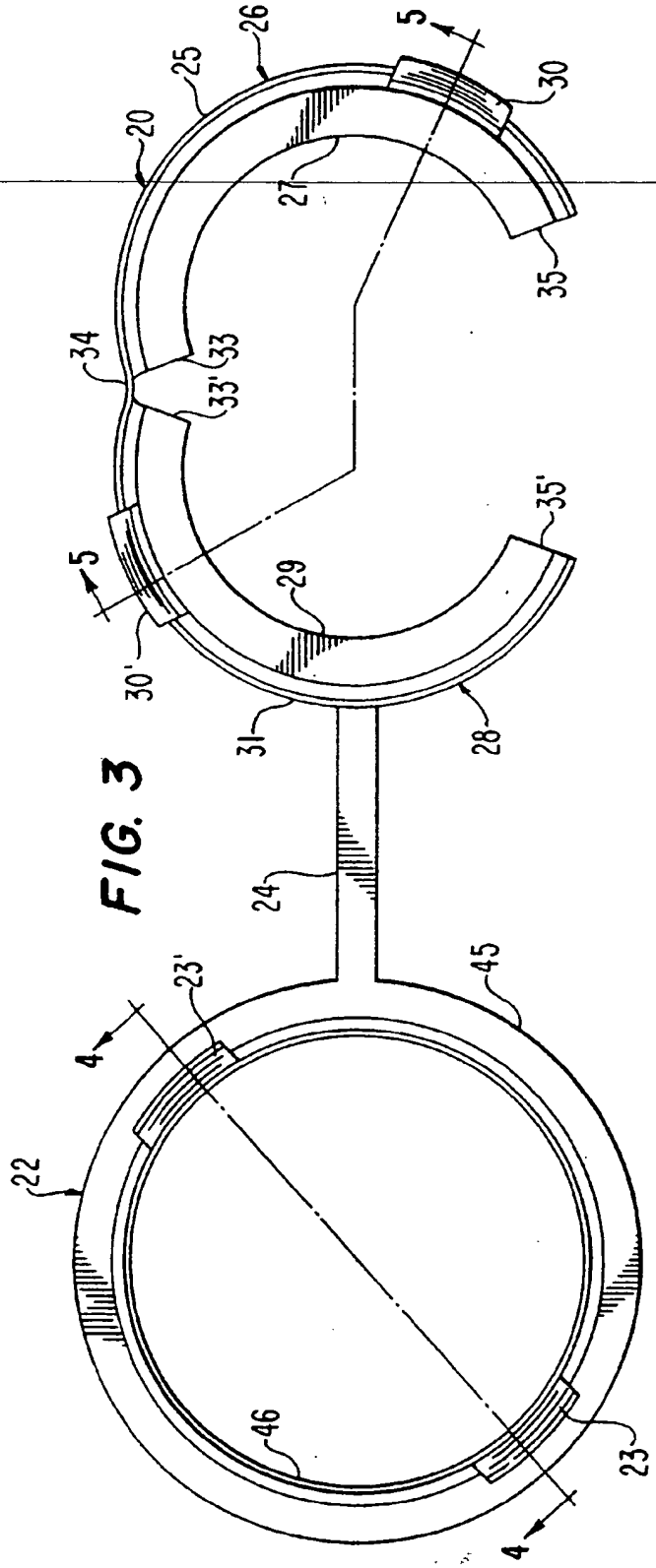


FIG. 3

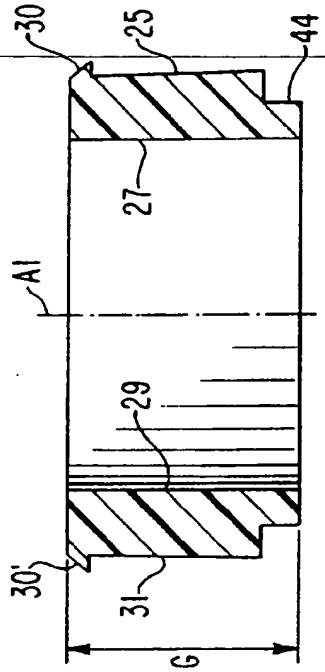


FIG. 5

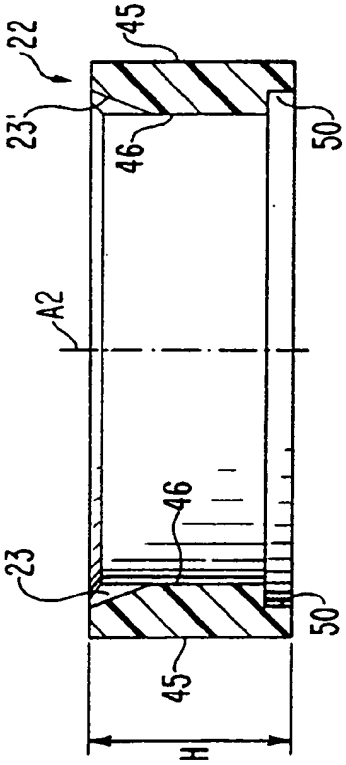


FIG. 4

FIG. 7

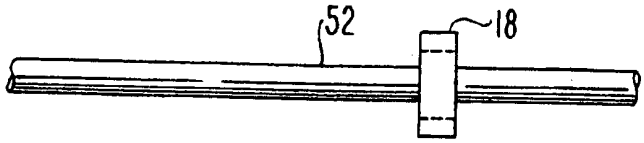


FIG. 8

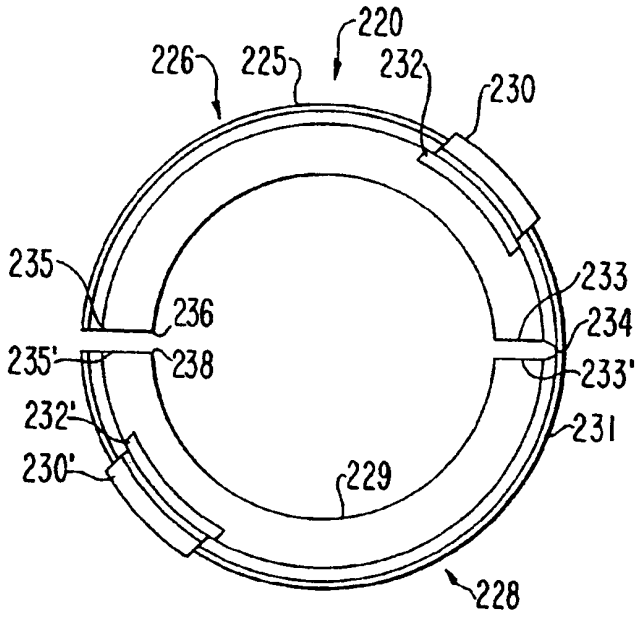


FIG. 9A

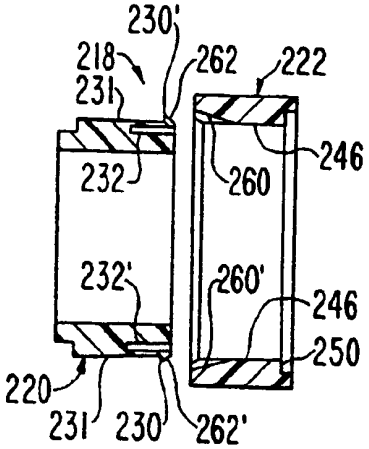


FIG. 9B

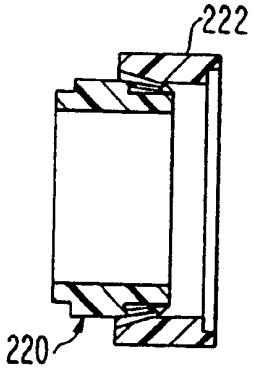
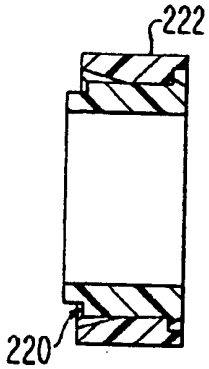


FIG. 9C



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(43) Date of publication of application :
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(84) Designated Contracting States :
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(88) Date of deferred publication of search report :
27.10.93 Bulletin 93/43

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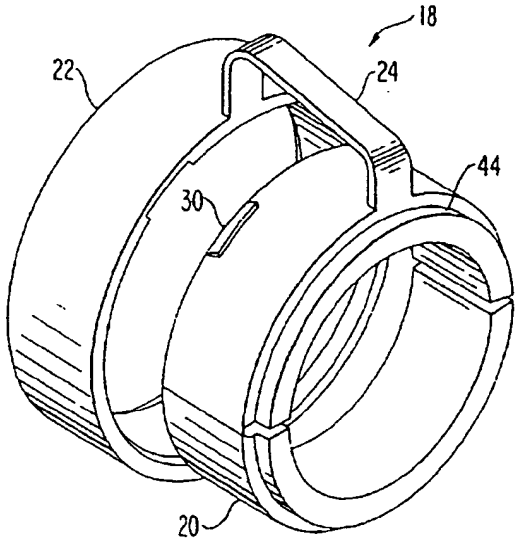
FIG. 1



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EUROPEAN SEARCH REPORT

Application Number EP 92 30 1337

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP-A-0 405 109 (HOESCH AG) * column 3, line 19 - line 47; figure 1 *	1-4,7	B60G21/055 F16B9/02
Y	US-A-4 799 818 (M. SUDIMAK ET AL.) * column 3, line 34 - line 48; figure 3 *	1-4,7	
X		9,10	
A	EP-A-0 381 566 (HUTCHINSON) * column 3, line 40 - line 57; figures 2,3 *	1-4	
A	FR-A-1 373 436 (CARR FASTENER COMPANY LIMITED) * claim 1; figures 2,7 *	9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B60G
F16B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	25 AUGUST 1993	WESTERMAYER W.

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